Before the
Federal Communications Commission
Washington, D.C. 20554

In the matter of	)	
	)	
Flexibility for Delivery of	)	
Communications by Mobile Satellite	)	IB Docket No. 01-185
Service Providers in the 2 GHz Band, the	)	
L-Band, and the 1.6/2.4 GHz Bands	)	

Memorandum Opinion and Order and

Second Order on Reconsideration

Adopted: February 10, 2005 **Released: February 25, 2005**

By the Commission: Commissioner Copps approving in part, concurring in part, and issuing a separate statement.

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I. INTRODUCTION

1. By this *Memorandum Opinion and Order and Second Order on Reconsideration*, the Commission revises the rules adopted in 2003 for flexibility in the provision of Mobile Satellite Service (MSS) communications, permitting the addition of ancillary terrestrial components (ATC) to MSS systems. We reaffirm that ATC is a part of, and ancillary to, MSS. We reconsider and substantially change certain technical standards for ATC in the L-band, in order to permit MSS/ATC licensees flexibility in designing and operating their ATC while at the same time preventing harmful interference from ATC to co-primary MSS licensees in the L-band. We also allow certain increases in ATC base station power because it has been demonstrated that these increases will not cause harmful interference. Finally, we amend the rules for authorizing MSS operators to add ATC to their networks.

II. EXECUTIVE SUMMARY

2. This *Memorandum Opinion and Order and Second Order on Reconsideration* addresses eight petitions for reconsideration of prior Commission decisions regarding ATC operations. These decisions fall into four areas: (1) gating criteria, (2) uplink interference, (3) downlink interference, and (4) licensing issues.

3. Gating criteria are conditions that an MSS operator must meet in order to receive authorization to operate ATC. This *Memorandum Opinion and Order and Second Order on Reconsideration*:

- Affirms our prior decision not to require a specific percentage of MSS system capability to be reserved for MSS operation, and

- Clarifies that all MSS/ATC equipment must be able to communicate via both MSS and ATC, and that services must be available through both MSS and ATC.

4. Uplink interference issues address the protection of other co-primary MSS operators in the L-band from harmful interference from ATC operations. This *Memorandum Opinion and Order and*

Second Order on Reconsideration changes the basis of interference protection from a list of specific technical requirements to a limit on the increase in interference an MSS/ATC network can cause to other MSS operators' satellites, leaving MSS/ATC operators free to design and operate their systems as they consider best, within the interference standards.

5. Downlink interference issues address the protection of MSS earth stations from interference from ATC. This *Memorandum Opinion and Order and Second Order on Reconsideration*:

- Raises the limits on ATC base station power, while continuing to protect other MSS operators' earth stations,

- Allows higher ATC signal strength near airports and waterways, while continuing to protect other MSS operators' earth stations, and

- Relaxes overhead gain limits for ATC base stations.

6. Licensing issues address how MSS operators will be granted ATC authority. This *Memorandum Opinion and Order and Second Order on Reconsideration*:

- Reaffirms that MSS/ATC authority is ineligible for competitive bidding,

- Reaffirms that public notice and comment will be provided in consideration of applications for ATC authority, and

- Declines to grant conditional authority, requiring instead that MSS operators be in compliance with all gating criteria before they can be authorized to provide ATC.

III. BACKGROUND

7. MSS is a radiocommunication service involving transmission between mobile earth stations and one or more space stations.[1] The Commission has allocated and assigned spectrum in several bands to MSS.[2] MSS systems can provide communications in areas where it is difficult or impossible to provide communications coverage via terrestrial base stations, such as remote or rural areas and non-coastal maritime regions.[3] A disadvantage of MSS is the fact that the satellite link is susceptible to blocking by structural attenuation, particularly in urban areas and inside buildings.[4]

8. After receiving applications from MSS operators requesting authority to re-use their assigned spectrum to provide terrestrially-based service, we began this proceeding to consider permitting MSS operators to integrate terrestrial services into their satellite networks, in order to augment coverage in areas where their satellite signals are largely unavailable due to blocking.[5] After receiving voluminous public comment on whether to permit MSS operators to operate ATCs, and under what restrictions such

[1] *See* 47 C.F.R. § 2.1(c).

[2] MSS is allocated spectrum at 1525-1559 MHz (space-to-Earth), 1610-1660.5 MHz (Earth-to-space), 2483.5-2500 (space-to-Earth), 2000-2020 MHz (Earth-to-space), and 2180-2200 MHz (space-to-Earth). *See* 47 C.F.R. § 2.106.

[3] *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile Satellite Service*, IB Docket No. 01-185, ET Docket No. 95-18, Notice of Proposed Rulemaking, FCC 01-225, 16 FCC Rcd 15,532 at ¶ 1 (2001) (*MSS Flexibility NPRM*).

[4] *See id.*

[5] *See id.*

operations should be permitted, we released a *Report and Order* that permits MSS operators to provide integrated ATC within their assigned MSS spectrum, and adopted rules pertaining to the licensing and operation of ATC systems.[6]

9. *MSS Flexibility R&O*. In deciding to permit MSS operators to integrate ATC into their MSS systems, we stated that "permitting MSS licensees to enhance spectrum efficiency through ATC represents a superior choice to continuing with the regulatory status quo."[7] Further, we found that MSS/ATC would expand the consumer market MSS is capable of serving, leading to economies of scale and lower prices for consumers.[8] Granting authority for integrated MSS/ATC would also allow MSS operators to offer the capability of receiving calls via both satellite and terrestrial radio links with a single dual-mode handset and a single telephone number, whereas current dual-capability MSS/Commercial Mobile Radio Service (CMRS) handsets require separate numbers for MSS and CMRS services.[9] Moreover, MSS/ATC would eliminate operational and transactional difficulties and costs for MSS operators in negotiating separate terrestrial roaming agreements with various terrestrial CMRS operators within the MSS operators' service areas.[10] Finally, we found that MSS/ATC would enhance the ability of the national and global telecommunications systems to protect the public by offering ubiquitous service to law enforcement, public aid agencies, and the public,[11] and would strengthen competition in the telecommunications market.[12]

10. We concluded that our decision to permit MSS operators to acquire ATC authority did not establish the requisite conditions for assigning licenses through competitive bidding under section 309(j) of the Communications Act of 1934, as amended (Communications Act).[13] We also concluded that granting ATC authority by modifying MSS operators' rights under their existing authorizations and declining to authorize separate terrestrial authorizations in MSS bands precluded the filing of mutually exclusive applications, a requirement for assigning licenses by competitive bidding.[14] Further, we found that granting ATC authority under the conditions we prescribed would not unjustly enrich MSS operators because MSS, even with ATC, is not a close substitute for terrestrial CMRS for most customers, and will not compete with CMRS directly.[15] With regard to licensing, we decided to implement geographic area licensing of ATC base stations generally, and individual licensing of ATC base stations in situations where the stations could pose threats of adverse effects to the environment, public health, scenic and historic locations, tribal lands, aviation, or related concerns.[16] We also decided that applications for ATC

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[6] *See Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, IB Docket Nos. 01-185 and 02-364, Report and Order and Notice of Proposed Rulemaking (*MSS Flexibility R&O*), FCC 03-15, 18 FCC Rcd 1962 (2003). The Notice of Proposed Rulemaking portion of the document initiated the new IB Docket No. 02-364 regarding spectrum sharing in the Big LEO bands and is not relevant to the discussion herein.

[7] *See id.* at 1974, ¶ 22.

[8] *See id.* at 1975, ¶ 24.

[9] *See id.* at 1976, ¶ 25.

[10] *See id.* at 1977, ¶ 26.

[11] *See MSS Flexibility R&O*, 18 FCC Rcd at 1978, ¶ 28.

[12] *See id.* at 1979, ¶ 30.

[13] *See id* at 2068, ¶ 219.

[14] *See id.* at 2068-69, ¶ 221.

[15] *See id.* at 2072, ¶ 229.

[16] *See id.* at 2076-77, ¶ 239.

authority would be treated as minor modifications to the MSS operators' space station licenses.[17] Further, foreign-licensed MSS operators permitted to offer service in the United States under a Letter of Intent (LOI) would apply for ATC authority by modification of the LOI.[18] We specified that ATC construction and testing may not begin until after an ATC authorization has been issued, but may begin prior to commencement of the provision of MSS services.[19] Finally, we decided to license MSS ATC handsets by our equipment certification procedure under Part 2, Subpart J of the rules.[20]

11. To protect other users of MSS spectrum, both satellite and terrestrial, from harmful interference from ATC, we adopted a number of technical rules for ATC. These rules vary for the three MSS bands, and apply power limits for ATC base stations and MSS handsets, and require separation distances from airports or navigable waterways for ATC base stations.[21] The MSS/ATC operator is also required to resolve any harmful interference to other services caused by its ATC base stations or handsets.[22]

12. Sua Sponte Order. On July 3, 2003, we released an *Order on Reconsideration (Sua Sponte Order)*, in which we reconsidered and clarified certain aspects of the *MSS Flexibility R&O* on our own motion.[23] Because we had decided in the *MSS Flexibility R&O* that we would not grant ATC authority to any MSS operator until that MSS operator satisfied all of several preconditions for operating ATC, collectively known as gating criteria,[24] we clarified that we will allow preoperational ATC construction and testing in accordance with the technical rules, at any time after physical construction of the MSS satellites has begun. Such construction and testing is to be at the MSS operator's risk, and does not presuppose authorization to operate an ATC.[25] Further, we clarified that we would consider ATC applications before each of the gating criteria was met, provided the MSS operator applying for ATC authorization makes a substantial showing that its MSS and ATC operations will meet the gating criteria.[26] Also in our *Sua Sponte Order*, we specified that no ATC authority will be granted until we are satisfied that each of the gating criteria has been met or will be met at the same time the application is granted.[27] As a result of this decision, we also eliminated the rule requiring MSS operators to have a conditioned ATC authorization before engaging in preoperational constructing and testing, instead allowing such construction and testing at any time after an MSS operator has begun construction of satellites and has informed us of its intent to construct and test ATC facilities.[28] Finally, we required all initial applications for ATC authority to be placed on public notice, in order to allow interested parties to

[17] *See MSS Flexibility R&O*, 18 FCC Rcd at 2077, ¶ 240.

[18] *See id.* at 2080, ¶ 245.

[19] *See id.* at 2082-83, ¶ 250.

[20] *See id.* at 2082, ¶ 248. *See also* 47 C.F.R. Part 2, Subpart J.

[21] *See* 47 C.F.R. §§ 25.147(c), 25.252-25.254.

[22] *See* 47 C.F.R. § 25.255.

[23] *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, IB Docket No. 01-185, Order on Reconsideration (*Sua Sponte Order*), FCC 03-162, 18 FCC Rcd 13,590 (2003).

[24] Gating criteria are designed to ensure that MSS operators may not operate terrestrial services unrelated to their satellite operations. For a detailed discussion of gating criteria, see *infra*.

[25] *See Sua Sponte Order* at 13,593, ¶ 7.

[26] *See id.* at 13,594-95, ¶ 10; 47 C.F.R. § 25.149(f). This will allow us to consider granting ATC authority while the construction and testing of the MSS system is ongoing.

[27] *See Sua Sponte Order* at 13,594-95, ¶ 10.

[28] *See id.* at 13,595-96, ¶ 13.

comment on the applications. Such public notice will contain a statement that any party objecting to an application for ATC authority bears the burden of demonstrating that the applicant's proposed ATC is not consistent with the rules.[29]

13. Seven parties filed petitions for reconsideration and/or clarification of the *MSS Flexibility R&O*.[30] One party filed a petition for reconsideration of the *Sua Sponte Order*.[31] Eight parties filed oppositions to or comments on the petitions for reconsideration or clarification,[32] and six parties filed replies to oppositions or comments.[33]

14. On July 8, 2003, AT&T Wireless Services, Inc. and Cellco Partnership, doing business as Verizon Wireless, petitioned the U.S. Circuit Court of Appeals for the District of Columbia Circuit for review of the *MSS Flexibility R&O*.[34] The petitioners in that action challenge our decision to allow ATC in MSS spectrum as unreasoned decisionmaking and not in accordance with the law.[35]

15. MSV's ATC License. On November 18, 2003, MSV applied for authority to provide ATC in the United States in conjunction with its provision of MSS in the United States via satellites licensed by the Commission and Industry Canada.[36] MSV requested waiver of many of our technical rules for L-Band ATC operation, arguing that the flexibility afforded by such waivers would permit it to operate more efficiently without impairing its own MSS operations or causing harmful interference to other MSS systems.[37] MSV contended that grant of its ATC applications and the associated waiver requests would enable it, for the first time, to offer a ubiquitous, high-quality, integrated mobile service throughout the United States.[38] On February 9, 2004, the International Bureau issued a public notice that these ATC applications were accepted for filing, specifying a schedule for filing comments, petitions to deny, and reply pleadings.[39]

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[29] *See id.* at 13,596, ¶ 14.

[30] Petitions for reconsideration and/or clarification were filed by the Society of Broadcast Engineers, Inc. (SBE); the U.S. GPS Industry Council (GPSIC); Mobile Satellite Ventures Subsidiary LLC (MSV); the Cellular Telecommunications & Internet Association (CTIA), Inmarsat Ventures PLC (Inmarsat); the Boeing Co. (Boeing); and Cingular Wireless LLC (Cingular).

[31] Boeing filed a petition for reconsideration of the *Sua Sponte Order*.

[32] Oppositions to petitions were filed by Boeing; MSV; Inmarsat; Globalstar, L.P. (Globalstar); ICO Global Communications (Holdings) Limited (ICO); and AT&T Wireless Services, Inc., Cingular, and Verizon Wireless (jointly the Wireless Carriers). Comments on the petitions were filed by Aeronautical Radio, Inc. and the Air Transport Association (ARINC/ATA) and Delta Airlines, Inc. (Delta).

[33] Replies to oppositions were filed by Boeing, SBE, MSV, Cingular, and CTIA. GPSIC filed a reply to comments.

[34] *See AT&T Wireless Services, Inc. and Cellco Partnership d/b/a Verizon Wireless v. FCC*, Case No. 03-1191 (D.C.Cir. filed Jul. 8, 2003) (stayed pending exhaustion of administrative remedies).

[35] *See id.*, Petitioners' Non-Binding Statement of Issues to be Raised 2 (filed Aug. 8, 2003).

[36] In accordance with instructions in the *MSS Flexibility R&O*, MSV filed three applications for ATC authority on November 18, 2003: an application for authority to provide ATC in conjunction with MSS via MSV's currently operational satellite, AMSC-1; an amendment to MSV's pending application for license authority for a second-generation L-band MSS satellite, requesting authority to provide ATC in conjunction with provision of MSS via that satellite; and an application for modification of MSV's blanket license for provision of MSS in the United States via a Canadian-licensed L-Band MSS satellite operated by an affiliated company, MSV Canada, for authority to offer ATC in the United States in conjunction with its provision of MSS via that satellite.

[37] Application for Minor Modification and Amendment filed Nov. 18, 2003 ("MSV ATC Application"), at 2.

[38] *Id.*

[39] Public Notice, Report No. SPB-200 (Feb. 9, 2004).

16. Inmarsat filed comments in opposition to MSV's ATC applications, raising concerns about the potential interference that the proposed ATC operation could cause to Inmarsat's current and next-generation MSS networks.[40] The National Telecommunications and Information Administration (NTIA) also submitted written comments on the ATC applications. For protection of Aeronautical Mobile Satellite (Route) Service (AMS(R)S) and Global Maritime Distress and Safety System (GMDSS) operations, NTIA recommended that MSV's waiver requests pertaining to power limits for ATC base stations be granted only in part, subject to restrictions on operation in the vicinity of navigable waterways and limits on out-of-channel emissions. NTIA also recommended use of a certain measurement technique in compliance testing to ensure that out-of-band emissions from MSV's ATC mobile terminals will not interfere with reception of satellite radionavigation signals in the 1559-1610 MHz band.[41] Other interested parties filed comments that expressed no opinion on the merits of MSV's waiver requests but urged us to grant the ATC application or promptly take action on it.[42]

17. On August 2, 2004, MSV filed a request for expedited action on its application.[43] MSV acknowledged in this filing that some of the issues raised by its waiver requests were closely intertwined with issues raised in its petition for reconsideration of the *MSS Flexibility R&O*. Nevertheless, MSV asked the Bureau to grant "core elements" of its ATC application in advance of our disposition of the petitions for reconsideration in the ATC rulemaking proceeding.

18. On November 8, 2004, the International Bureau granted MSV's applications for ATC authority in part, granting some of its waiver requests, denying others, and deferring resolution of some issues that were also raised in the petitions for reconsideration in this proceeding.[44]

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[40] Opposition of Inmarsat Ventures Ltd, filed March 25, 2004 ("Inmarsat Opposition").

[41] *See* 47 C.F.R. § 25.253(g)(3).

[42] *See* letter from Raul R. Rodriguez, counsel for the U.S. GPS Industry Council, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Mar. 24, 2004) (advocating grant); letter from Eric Epley, Executive Director, Southwest Texas Regional Advisory Council For Trauma, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Apr. 14, 2004) (advocating expeditious action); letter from Karl-Heinz Ziwica, Vice President for US Engineering, BMW of North America LLC, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Apr. 23, 2004) (advocating grant); letter from Kenneth B. Taylor, Director, North Carolina Department of Crime Control and Public Safety, Division of Emergency Management, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Apr. 20, 2004) (advocating expeditious action); letter from Conrad Burns, U.S. Senator, to Michael Powell, Chairman, FCC, IB Docket 01-185 (dated May 21, 2004) (advocating expeditious action); letter from Tom Davis, U.S. Representative, to Michael Powell, Chairman, FCC, IB Docket 01-185 (dated Jun. 3, 2004) (advocating expeditious action); letter from Howard McConnell, Chairperson, Yurok Tribe, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Jun. 14, 2004) (advocating grant).

[43] Letter from Lon C. Levin, Vice President, MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (Aug. 2, 2004) (MSV Aug. 2 *Ex Parte* letter), filed as attachment to letter from Henry Goldberg, counsel for Motient, Inc., to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Aug. 2, 2004). Also see letter from Lon C. Levin, Vice President, MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Oct. 4, 2004) (modifying request for expedited action).

[44] *See Mobile Satellite Ventures Subsidiary LLC Application for Minor Modifications of Space Station License for AMSC-1; Minor Amendment to Application for Authority to Launch and Operate a Next-Generation Replacement MSS Satellite, Application for Minor Modification of Blanket License for Authority to Operate Mobile Earth Terminals with MSAT-1*, File Nos. SAT-MOD-20031118-00333, SAT-AMD-2003-1118-00332, SES-MOD-20031118-01879, Order and Authorization, DA 04-3553 (rel. Nov. 8, 2004) *(ATC License Order)*. On December 8, 2004, Inmarsat filed an *Application for Review* of this Order and Authorization. The *Application for Review* is currently under consideration.

IV. DISCUSSION

A. Gating Criteria

19. Background. In the *MSS Flexibility R&O*, we established several prerequisites that MSS operators would be required to meet in order to be allowed to offer ATC. These prerequisites have been collectively called "gating criteria." To ensure that ATC will be ancillary to provision of MSS, we adopted a requirement that MSS operators must provide substantial satellite service to be eligible for ATC authorization.[45] We defined substantial satellite service as the capability of providing continuous satellite service over the entire geographic area of satellite coverage required in our rules,[46] maintenance of spare satellites to replace destroyed or degraded satellites expeditiously,[47] and commercial availability of service, meaning offering MSS service to the general public for a fee, throughout the mandatory geographic coverage area.[48] We also required the offer of MSS and ATC services to be integrated. To demonstrate integrated service, MSS/ATC operators could demonstrate that all handsets offered were dual-mode (MSS and ATC), or could submit individualized substantial showings to demonstrate integrated service.[49] Finally, we required MSS operators to offer ATC only in the frequency bands in which they are authorized to provide MSS.[50] We considered and rejected proposals from commenters to require that MSS traffic be quantitatively "primary" or "predominant" in MSS/ATC systems,[51] to require that all MSS/ATC calls be routed through a satellite;[52] to require that MSS operators demonstrate a technical inability to serve proposed ATC areas by satellite as a condition of ATC;[53] and to impose additional fees for MSS operators who wish to provide ATC.[54] Three petitions filed in the instant proceeding request that we reconsider various aspects of the gating criteria for ATC and require MSS/ATC operators to dedicate a certain amount of capacity exclusively for MSS;[55] require MSS/ATC handsets to always attempt to communicate via the satellite first;[56] clarify that all MSS/ATC handsets

[45] *See MSS Flexibility R&O* at 2001-02, ¶ 72.

[46] *See id.* at 2003-04, ¶ 75. We required MSS providers seeking to provide ATC to demonstrate coverage: for the 2 GHz MSS band, of all 50 states, Puerto Rico, and the U.S. Virgin Islands 100% of the time; for the L-band, of 50 states, Puerto Rico, and the U.S. Virgin Islands 100% of the time unless technically impossible from the orbit position(s) of the satellite(s); for Big LEO band, of all locations between 70° North latitude and 55° South latitude for at least 75% of every 24-hour period and on a continuous basis throughout all 50 states, Puerto Rico, and the U.S. Virgin Islands. *See also* 47 C.F.R. 25.147(b)(1).

[47] *See MSS Flexibility R&O* at 2007, ¶ 83. We required operational NGSO MSS providers wishing to provide ATC to maintain at least one spare satellite in orbit, and operational GSO MSS providers wishing to provide ATC to maintain a spare satellite on the ground within one year of commencing operations and to launch the spare satellite in the first commercially reasonable launch window following satellite failure. *See also* 47 C.F.R. § 25.147(b)(2).

[48] *See MSS Flexibility R&O* at 2008, ¶ 86. *See also* 47 C.F.R. § 25.147(b)(3).

[49] *See MSS Flexibility R&O* at 2008-09, ¶¶ 87-88. *See also* 47 C.F.R. § 25.147(b)(4).

[50] *See MSS Flexibility R&O* at 2011-12, ¶ 93. In the 2 GHz MSS band, ATC is limited to the MSS provider's selected assignment. In the Big LEO band, ATC is limited to no more than 5.5 megahertz of spectrum in each direction of operation, and must conform to Big LEO MSS band-sharing arrangements. In the L-band, ATC is limited to the frequencies available for the providers of MSS operations under coordination in accordance with the Mexico City Memorandum of Understanding and successor agreements. *See also* 47 C.F.R. § 25.147(b)(5).

[51] *See MSS Flexibility R&O* at 2014-15, ¶ 99.

[52] *See id.* at 2015, ¶ 100.

[53] *See id.* at 2015, ¶ 101.

[54] *See id.* at 2015-16, ¶ 102.

[55] *See* Cingular, *Petition for Reconsideration* at 3; CTIA, *Petition for Reconsideration* at 3-4.

[56] *See* Cingular *Petition* at 10-11.

must be dual-mode to qualify for our "safe harbor" demonstration of integrated MSS/ATC service;[57] forbid ATC-only service subscriptions;[58] clarify that gating criteria must be met for each band in which an MSS operator seeks authority to provide ATC;[59] and clarify that our geographic coverage requirement applies only to the extent technically feasible.[60]

1. Substantial Satellite Service

20. We deny petitioners' requests to require that a specific percentage of an MSS/ATC operator's capacity be reserved exclusively for MSS.[61] We note that we refuted similar arguments regarding "primary" or "predominant" satellite service in the *MSS Flexibility R&O*[62] for reasons that we fully reaffirm, and that the petitions, oppositions, and replies do little more than simply rehash those arguments. We deny these requests because, as we stated in the *MSS Flexibility R&O*, we are unable to impose a quantitative criterion of MSS service in an MSS/ATC system that would not be arbitrary. First, the percentage of spectrum used by MSS and ATC will vary drastically in the different areas served by the satellites. In a rural area with a low population density and considerable terrain folding and other challenges to terrestrial system propagation, the MSS/ATC system will use most or all of its channels and time for MSS. In a densely-populated urban area with tall buildings whose structures prevent MSS service inside and block the communications path between handsets in the immediate vicinity and MSS satellites, the MSS/ATC system could use the large majority of its channels and time for ATC. Thus, we deny CTIA's proposal of allowing only 20% of the available channels in any spot beam to be used for ATC[63] because it would result in a grossly inefficient use of spectrum in many areas.

21. Similarly, we cannot predict what eventualities may cause traffic loading to increase or decrease, or how such loads will be distributed between ATC transmitters and MSS handsets. As Globalstar points out, considerations for allocating spectrum between MSS and ATC vary by time and geography.[64] Further, in a natural or other disaster, the higher efficiency of ATC may be crucial to providing telecommunications for the public. It is equally possible that such a disaster could damage or destroy the capacity of ATC, and possibly of terrestrial mobile communications as well. In such a circumstance, MSS would become critical even in an area where MSS is usually not the most efficient method of communication. Neither CTIA's recommendation of allowing a maximum of 20% of MSS capacity for ATC nor Cingular's recommendation that we require MSS/ATC operators to reserve at least 50% of their capacity for MSS service at all times[65] explains why these numbers are reasonable.

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[57] *See id.* at 11.

[58] *See* CTIA *Petition* at 6.

[59] *See* Cingular *Petition* at 15; CTIA *Petition* at 8.

[60] *See* Boeing, *Petition for Reconsideration of the Boeing Company* at 2.

[61] Cingular asserts that our rules requiring substantial satellite service are merely cosmetic and reflect unreasoned decisionmaking. *See* Cingular *Petition* at 3. Cingular and CTIA request that we adopt a specific percentage of satellite capacity that must be reserved for MSS operations. Cingular requests that we require MSS/ATC operators to reserve at least 50% of their capacity for MSS service at all times. *See id.* at 9-10. CTIA agrees that a numerical limit on ATC is needed, stating that "a reasonable criterion would be that the capacity in any satellite antenna beam is never reduced by more than 20% from what it would be in the absence of an [ATC]." CTIA *Petition* at 4. *See also* letter from Diane Cornell, CTIA, to Marlene Dortch, Secretary, FCC, IB Docket 01-185, Appx. at 5 (dated Feb. 2, 2005) (CTIA Feb. 2 *Ex Parte* letter).

[62] *See MSS Flexibility R&O* at 2013-14, ¶¶ 98-99.

[63] *See* CTIA *Petition* at 3-4.

[64] *See* Globalstar, *Consolidated Opposition of Globalstar, L.P.* at 5.

[65] *See id.* at 9-10.

22. Such imponderables as MSS usage and ATC usage in different parts of the country under different circumstances render any attempt to establish a single, fixed percentage of capacity that must be reserved for MSS highly problematic and uncertain. Further, such a requirement would substantially negate the value of dynamic frequency assignment in improving spectrum efficiency. We agree with commenters that assert that MSS/ATC operators will have an incentive to continue providing substantial satellite service.[66] Should we specify a fixed percentage of an MSS/ATC operator's spectrum that must be reserved for MSS operations, the MSS/ATC operator would probably have to permanently assign a certain number of channels in each spot beam for MSS traffic only, reducing the options available for dynamic frequency assignment. Imposition of a rigid percentage of MSS/ATC capacity that must be reserved for MSS would not be conducive to either business success or providing the best possible service to the public.

23. In addition, we find no basis in the record to conclude that MSS/ATC operators would surrender their single most valuable system feature, complete ubiquity of coverage, in order to compete with the already well developed and heavily financed terrestrial mobile systems. Rather, two factors strongly favor substantial satellite service in an MSS/ATC system. First, MSS/ATC customers will likely be drawn to MSS because of its ubiquity. Specifically, MSS, with or without ATC, will appeal most strongly to customers who expect to need communications in areas currently unserved by terrestrial mobile providers, such as rural areas, underpopulated areas, areas with significant hindrances to terrestrial radio propagation, and marine areas where terrestrial mobile base stations cannot be installed. Thus, customer demand will do much to ensure continuing substantial satellite service. Second, our rules require MSS/ATC licensees to retain capacity for providing MSS throughout their mandatory geographic coverage areas.[67] Nevertheless, we reiterate and reaffirm that the terrestrial service is to be offered on an *ancillary* basis by satellite licensees. The gating criteria we have adopted are intended to ensure compliance with this ancillary requirement. To the extent we receive specific complaints about a particular system, we will examine the totality of the services being offered to ensure that the terrestrial service is in fact ancillary to the satellite service. For these reasons, we again decline to establish a specific, additional requirement for substantial satellite service.

2. Integrated Service

24. We deny Cingular's request that we adopt a requirement that any MSS/ATC handset first attempt to place a call through the MSS component of the service and only call through the ATC if the satellite signal is unavailable or unreliable.[68] The *MSS Flexibility R&O* required that MSS/ATC providers

[66] ICO asserts that MSS operators will have an incentive to continue to provide robust satellite service because they have invested large sums of money in satellites, agreeing with our reasoning that MSS operators are "unlikely 'to abandon satellite services merely for the opportunity to compete only in the market for terrestrial mobile services where much larger, better financed competitors already engage in "'competitive, intense [and] aggressive price competition.'" *See* ICO, *Consolidated Opposition of ICO Global Communications (Holdings) Limited* at 5-6 (quoting *MSS Flexibility R&O* at 1982-83, ¶ 35). *See also* letter from Suzanne Hutchings Malloy, ICO, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 2 (dated Feb. 3, 2005) (ICO Feb. 3 *Ex Parte* letter). Boeing concurs, stating that the business plan of MSS/ATC operators must be to provide mobile services in all locations in the United States, especially those locations unserved or underserved by terrestrial operators, and that MSS operators will invest in the additional cost of ATC transmitters only where the MSS signal is not available or in heavily populated "bottleneck" locations. *See* Boeing, *Opposition of the Boeing Company* at 5. MSV states that its system would meet a gating factor that restricts ATC from significantly decreasing satellite capacity but that such a gating criterion is unnecessary and could hinder MSS/ATC operators in seeking financing. *See* MSV, *Consolidated Opposition to and Comments on Petitions for Reconsideration* at 15-16. *See also* letter from Lon. C. Levin, Vice President MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 2-4 (dated Feb. 3, 2005).

[67] *See* 47 C.F.R. § 25.149(a)(2), (6).

[68] *See* Cingular *Petition* at 10-11.

offer a single, integrated service. We disagree with Cingular and CTIA that such a requirement is the only way to ensure integrated service.[69]

25. We addressed this issue in the *MSS Flexibility R&O*, stating that "requiring satellite-routing would defeat most of the benefits of authorizing ATC in the first instance."[70] None of the parties seeking reconsideration presented new facts or arguments to change our analysis. We agree with MSV and Globalstar that adding a requirement that the MSS/ATC handset attempt to acquire the satellite first would impair operational efficiency.[71]

26. We also agree with Boeing that all modern wireless communications networks involve continuous instructions to handsets regarding the location and type of base stations assigned, and that the efficiencies of dynamic frequency assignment would be hampered by a firm rule that handsets must try to acquire the MSS communications path first.[72] Any "satellite first-look" requirement would involve the use of extra time and power in the handset, and would complicate control signals from the MSS satellite and ATC base stations to the handsets. Such a requirement would increase the cost of providing service, hinder call completion, and ultimately reduce system efficiency. Further, any such requirement could ultimately force a weaker satellite signal on consumers in areas where a stronger ATC signal was available, but a satellite signal was also available. We find no significant public interest benefit to offset these serious disadvantages.

27. We can see no reason why an MSS/ATC operator would install ATC base stations in any area where customer demand can be adequately accommodated by the operator's satellite system. On the contrary, the MSS/ATC operators' interest in avoiding unnecessary capital expenditures would deter them from installing ATC base stations in non-urban areas where traffic is light enough to be handled by MSS alone. Thus, we believe that MSS/ATC operators will only install ATC base stations in areas where the satellite signal is substantially affected by blocking or where consumers demand more communications paths than the satellite can provide. These are the precise situations for which we authorized ATC. Therefore, we disagree with CTIA's contention that MSS/ATC handsets will always attempt to acquire ATC first, and that as a result ATC will not be ancillary to MSS.[73] On the contrary, we presume that an MSS/ATC handset will be in constant communication with the MSS/ATC network, and will choose the best communication path available to it, whether MSS or ATC. We therefore decline to add an artificial and spectrally inefficient requirement to the MSS/ATC rules.

3. Dual-Mode Devices

28. Background. In the *MSS Flexibility R&O*, we stated that a "safe harbor" method by which MSS operators could demonstrate MSS/ATC system integration without specific, detailed showings of system integration is to provide ATC services via dual-mode handsets that can also be used for communication via the provider's satellite system.[74] Cingular requests that we clarify that the integrated

[69] *See id. See also* CTIA Feb. 2 *Ex Parte* letter at 5.

[70] *MSS Flexibility R&O* at 2015, ¶ 100.

[71] *See* MSV *Opposition* at 16. Globalstar adds that such a requirement is spectrally inefficient, and would require handsets to attempt to use the MSS communications path whenever the MSS signal was above a certain threshold, regardless of actual communications traffic, leading to denials of service when the users could use ATC to complete their calls. *See* Globalstar *Opposition* at 7.

[72] *See* Boeing *Opposition* at 8.

[73] *See* CTIA *Reply* at 5. *See also* CTIA Feb. 2 *Ex Parte* letter at 5.

[74] *See MSS Flexibility R&O* at 2008-09, ¶ 87. Applicants for MSS/ATC may prove integrated service by demonstrating "[t]he MSS/ATC operator will use a dual-mode handset that can communicate with both the MSS

(continued....)

service "safe harbor" can be satisfied only by a dual-mode handset that "actually incorporates the capability to communicate with bo the satellite and the ATC base stations."[75] MSV responds to this request, ask hat we clarify tha mponent kits" cons g of a handset with all of the hardware and software n ry for access to b ATC and MSS, and parate antenna booster needed for communic with MSV's current generation satellite meets the definition of a dual-mode handset.[76]

29. Discussion. W clarify that a "dual-mode handset," for the purposes of 47 C.F.R. § 25.149(b)(4)(i) shall cons of a handset which, when sold to the customer, contains all the hardware and software necessary to acquire and communicate via both the operator's MSS system's signal and its ATC system's signal, either within the casing or permanently affixed to the casing in such a fashion that no part of the equipment would ordinarily be detached from the casing unless defective and in need of replacement. Specifically, we will not ordinarily consider "component kits" as described by MSV to be dual-mode handsets. Any handset that requires a supplementary attachment to acquire and use both the MSS and the ATC signal will not be considered dual-mode.

30. We also extend this clarification to apply to personal digital assistants (PDAs), laptop computers, and other digital devices communicating via MSS/ATC. In the *MSS Flexibility R&O*, we exempted such devices from the dual-mode "safe harbor" demonstration of integrated service for MSS/ATC.[77] Cingular requests that we eliminate this exception or clarify its scope, claiming that otherwise potentially significa errestrial services could be provided on a stand-alone basis.[78]

31. We agree with Cingular that "there is no clear definition of what constitutes a PDA at a time when handsets have begun to incorporate various computer and Internet access functions, along with voice capability."[79] By exempting such devices from our safe har we would generate considerable confusion over precisely what devices would qualify for safe harb y being dual-mode. We also agree with other parties that argue that digital devices should not necessarily be required to be dual-mode.[80] These parties, however, ignore the fact that dual-mode devices are not required under our gating criteria, they are merely required to qualify for the safe harbor demonstration of integrated service. Any MSS/ATC operator that chooses not to make its handsets or digital devices dual-mode can satisfy our integrated service gating criterion by presenting sufficient evidence demonstrating that they will offer integrated service. For example, ICO expresses its intention to offer digital voice and data through satellite air-interface repeaters that provide service links to satellites, claiming that such repeaters could be attached to a number of devices, making it unnecessary to make each individual device satellite-capable.[81]

32. We agree with Cingular and CTIA that there is no clear distinction between PDAs and

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network and the MSS/ATC to provide the proposed ATC service," or by an alternate showing establishing the MSS/ATC service is integrated. *See* 47 C.F.R. § 25.1 b)(4).

[75] Cingular *Petition* at 11. Cingular states that MSS/ATC proponents "sought flexibility to offer 'dual mode' phones where the capability to access the sa lite was merely a component available at the point of sale." *Id.*

[76] *See* MSV *Opposition* at 17-18.

[77] *See MSS Flexibi &O* at 2009, n.229.

[78] *See* Cin ar *Pe* at 12.

[79] Cingular *etition* at 12. CTIA also points out that there are PDAs and other digital devices available on the market in the United States today incorporating voice and data capabilities. *See* CTIA *Petition* at 7. *See also* CTIA Feb. 2 *Ex Parte* letter at 6.

[80] *See, e.g.*, Inmarsat *Opposition* at 3-4

[81] *See* ICO *Opposition* at 3-4. *See also* ICO Feb. 3 *Ex Parte* letter at 3.

handsets that is relevant to our ATC rules. For this reason, we grant Cingular's request to the extent of finding that devices providing ATC, including PDAs and other digital devices, must be dual-mode, as defined above, for purposes of the "safe harbor" method of demonstrating integrated MSS/ATC service.[82] MSS/ATC operators choosing to use handsets or digital devices that are not dual-mode will be required to demonstrate that they offer integrated service.[83]

4. ATC-Only Subscriptions

33. We clarify that "integrated service" as used in this proceeding and required by 47 C.F.R. § 25.149(b)(4) forbids MSS/ATC operators from offering ATC-only subscriptions.[84] We reiterate our intention not to allow ATC to become a stand-alone system. The purpose of ATC is to enhance MSS coverage, enabling MSS operators to extend service into areas that they were previously unable to serve, such as the interiors of buildings and high-traffic density urban areas. We will not permit MSS/ATC operators to offer ATC-only subscriptions, because ATC systems would then be terrestrial mobile systems separate from their MSS systems. We therefore clarify that "integrated service" as used in this proceeding and required by 47 C.F.R. § 25.147(b)(4) forbids MSS/ATC operators from offering ATC-only subscriptions.[85]

5. Band-Specific Gating Criteria

34. We clarify that any MSS operator wishing to incorporate an ATC component into its system must meet the gating criteria for each spectrum band in which it wishes to provide ATC. We agree with Cingular and CTIA that we did not make this requirement explicit in the rules.[86] Accordingly, we require MSS operators seeking ATC authorization to meet the gating criteria in each band in which an MSS operator intends to provide ATC. The rules specify that in each of the 2 GHz MSS band, the Big LEO band, and the L-band, MSS/ATC is limited to the frequencies authorized for MSS communication.[87]

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[82] Because MSS is the basic service to which ATC is ancillary, we see no reason why we should prohibit or restrict MSS-only devices.

[83] For example, the International Bureau authorized MSV's use of a dual-mode handset with a separate antenna booster for its current generation satellites. The Bureau found that MSV had demonstrated satisfaction of the integrated service requirement, and that its proposal to use the separate antenna booster with a dual-mode handset designed to communicate with MSV's next generation satellite without a booster to be a reasonable temporary solution that will enhance economic efficiency. *See ATC License Order* at ¶ 21.

[84] CTIA requests that we forbid MSS/ATC operators to offer "ATC-only" subscriptions to customers, stating that such a requirement would ensure that MSS/ATC operators would offer ATC only as part of an integrated system with MSS as the primary component. *See* CTIA *Petition* at 6; CTIA Feb. 2 *Ex Parte* letter at 5. No party explicitly opposes this request, but Globalstar states that a "customer should have the option of taking an ATC-only service at a high data rate" in urban areas where the customer does not expect to leave the ATC-covered area. Globalstar *Opposition* at 8-9.

[85] Because MSS is the basic service to which ATC is ancillary, we will not prohibit or restrict MSS-only service subscriptions.

[86] Cingular states that "[w]hile the Commission has made it clear that it does not intend to allow gaming of its ATC rules [footnote omitted], the failure to explicitly state that satisfaction of the gating criteria is license/band-specific and not licensee-specific presents that opportunity." Cingular *Petition* at 15. CTIA adds that it believes the Commission intended to make satisfaction of gating criteria a precondition to the grant of ATC authority for each MSS license, but that MSS operators should not be allowed to avoid their satellite obligations in one band by claiming they have met those obligations in another band. *See* CTIA *Petition* at 8; *see also* CTIA Feb. 2 *Ex Parte* letter at 7. *But see* ICO *Opposition* at 10 (arguing that Cingular's and CTIA's request is frivolous because the requirement of band-specific satisfaction of gating criteria is explicit in the rules) (citing *MSS Flexibility R&O* at 2011-12, ¶ 93; 47 C.F.R. 25.149(b)(5). *See also* Globalstar *Opposition* at 9.

[87] *See* 47 C.F.R. § 25.149(b)(5).

Further, as we have made clear, an ATC ancillary to the MSS system it supports. These requirements have the effect of obligating MSS operators to fulfill the gating criteria in each band in which the seek to provide ATC. Therefore we clarify that our gating criteria must be met in each band in which an MSS operator seeks authorization to provide ATC.

6. Geographic Coverage

35. We clarify our geographic coverage requirement by adding the phrase "if technically feasible" to the gating criteria for the 2 GHz MSS band in the MSS/ATC service rules. We agree with Boeing that the difference between our coverage requirements as an MSS/ATC gating criterion and our general requirement for GSO 2 GHz MSS operators is critical because it is not technically possible to provide MSS to all of Alaska using a GSO satellite system.[88]

36. The meaning of the phrase "consistent with the coverage requirements for 2 GHz MSS GSO operators" in the MSS/ATC gating criteria is that the MSS/ATC "coverage requirement" gating criterion is satisfied by a showing that the coverage requirements of the 2 GHz MSS service rules, including the exemption for technical infeasibility, are met. We therefore agree with Boeing that the technical feasibility clause should be in the rules.

B. Uplink Interference in the L-Band

37. Background. In the *MSS Flexibility R&O*, we extensively discussed and analyzed proposed technical rules for MSS/ATC, with the goal of adopting a flexible set of technical rules that would prevent harmful interference while permitting the rapid and economically efficient development of ATC. We addressed issues of self-interference, *i.e.*, the interference an ATC could cause to the MSS system of which it is a part; inter-system interference, *i.e.*, the interference an ATC could cause to other MSS systems; and out-of-band interference that ATC could cause to services other than MSS.

38. In the L-band,[89] unlike other MSS bands, each MSS operator is licensed for the entire band, but must coordinate with other users of the L-band to determine which channels each MSS operator may use. Under an international agreement known as the Mexico City Memorandum of Understanding (Mexico City MoU), five L-band MSS operators are to coordinate their use of the L-band, meeting annually to re-negotiate their coordination agreement. These negotiations have not occurred since 1999, and the 1999 coordination agreement remains in effect.[90] Because the channels used by the L-band MSS operators are interleaved,[91] inter-system interference protection is a significant challenge.

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[88] *See* Boeing *Petition* at 2. Our ATC rules state that a geostationary orbit (GSO) 2 GHz MSS operator must demonstrate that its system "can provide space-segment service covering all 50 states, Puerto Rico, and the U.S. Virgin Islands one-hundred percent of the time, consistent with the coverage requirements for 2 GHz MSS GSO operators." C.F.R. § 25.149(b)(1)(i). By contrast, the service rules for GSO 2 GHz MSS systems require the systems to be "capable of providing mobile satellite services on a continuous basis throughout the 50 states, Puerto Rico, and the U.S. Virgin Islands, *if technically feasible*." 47 C.F.R. § 25.143(b)(2)(iv) (emphasis supplied).

[89] The L-band consists of the bands assigned by the Commission in the United States for MSS operations: 1525-1544 MHz and 1545-1559 MHz for downlinks, and 1626.5-1645.5 MHz and 1646.5-1660.5 MHz for uplinks. *See* 47 C.F.R. § 2.106.

[90] The five operators in the L-band and their authorizing countries are MSV (United States), TMI (Canada), Inmarsat (United Kingdom), Solidaridad (Mexico), and Volna-More (Russia). *See MSS Flexibility R&O* at 1994, n.144.

[91] In the L-band, all licensees have equal rights to all channels in the band. The licensees coordinate their channel usage so that each licensee has some channels it uses exclusively, some it is not entitled to use, and some that it shares with other licensees. By contrast, in the Big LEO and 2 GHz MSS bands, each licensee has exclusive rights to a block of spectrum.

39. In the *MSS Flexibility R&O*, we based our analysis of interference potential on MSV's proposed ATC. MSV's proposal provided specific system features for us and parties to evaluate.[92]

40. We began our uplink interference analysis in the *MSS Flexibility R&O* with the level of interference that MSV claimed was appropriate for its next generation satellite to accept from its own ATC, or self-interference.[93] The analysis assumed that MSV's self-interference would increase no more than 0.25 dB with an ATC active and that, by using very general assumptions, the expected interference into an Inmarsat satellite receiver would be about the same, or less than, the interference received by MSV.94 We concluded that "the total noise increase in the Inmarsat-4 receiver would be on the order of 1.4%. The noise increase for the Inmarsat-3 satellite receiver would be on the order of 0.1%.95 Neither of these noise increases should hinder the Inmarsat operations."96 Accordingly, we adopted technical rules for L-band ATC that mandated adherence to the assumed design parameters,97 which were largely consistent with MSV's ATC design proposal at that time.98 Based on this data, we calculated MSV's satellite gain, receiver noise temperature, degradation of signals, and a number of other factors in the system design, and established a set of rules to ensure that ATC would not cause harmful interference to MSV's own satellite operations or to Inmarsat. These rules included a limitation on ATC base stations of 1725 nation-wide on any one channel,99 a requirement for power reduction from MSS/ATC handsets when they operate outside buildings (structural attenuation),100 limits on base station power and antenna

[92] *See MSS Flexibility R&O* at 2031-32, ¶ 132. Inmarsat, which could receive harmful interference from MSV's ATC, has had the opportunity to evaluate and comment upon MSV's proposal, as has NTIA. NTIA is the agency responsible for the telecommunications of the Federal government, including defense communications, aviation communications, and the Global Positioning System (GPS), among other systems and services. The Commission therefore works with NTIA in evaluating the potential for interference to, and the need for protection of, systems operated by the Federal government.

[93] *See id.* at 2033, ¶ 136. *See also* letter from Bruce Jacobs, counsel for MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 11 (dated Mar. 28, 2002), Table *SS Link Margin Degradation to Accommodate Intra-System Effect of ATC.*

[94] *See id.* at 2033, ¶ 137.

[95] The total radio "noise," or power that can interfere with the reception of desired signals, can be expressed as a "system temperature," which includes both the noise received from all sources by the system's antennas and the noise added by the system's own operation. The system noise temperature (T) of Inmarsat's satellite receivers is 600K. ΔT/T represents the rise in that noise temperature caused by a new source of noise, such as ATC. The equation calls for dividing the increase in the system noise temperature (Δ) by the noise temperature without the new source of noise (T). Thus, 36 ÷ 600 = 6%, so 6% ΔT/T in this case would be sufficient additional noise to raise the system temperature of Inmarsat's satellite receivers by 36 degrees Kelvin.

[96] *MSS Flexibility R&O* at 2170, Appx. C2, ¶ 2.1.1. Inmarsat-3 refers to the current generation of Inmarsat satellites. Inmarsat has planned to construct and launch Inmarsat-4 satellites in the future. These satellites will feature much higher receiver sensitivity and many more antenna beams, each covering a smaller area of the Earth's surface. These different characteristics required the Commission to evaluate the impact of potential interference on both the current and the planned Inmarsat satellites.

[97] "Below, we. . . provide an individual assessment of the potential for interference from MSV's ATC operations to Inmarsat's networks. . . ." *MSS Flexibility R&O* at 2143, Appx. C2. For a description of MSV's ATC, *see Application of Motient Services Inc.*, File Nos. SAT-LOA-19980702- 00066, SAT-AMD-20001214-00171 & SAT-AMD-20010302. *See also* Public Notice, Report No. SAT-00066 at 2 (rel. Mar. 19, 2001) (MSV Application). MSV later indicated that it would seek to use the same ATC network with its current-generation MSS system. *See* Letter from Carson E. Agnew, President and Chief Operating Officer, and P. Karabinis, Chief Technical Officer, MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Dec. 16, 2002).

[98] *See* 47 C.F.R. § 25.253.

[99] *See id.* at § 25.253(c).

[100] *See id.* at § 25.253(a)(8).

gain,101 and out-of-channel emissions limits.102 Several parties petitioned for changes to these rules.

1. Interference Standard

41. Upon review of the arguments in petitions and oppositions, we change the basis of the rules for uplink interference in the L-band. As a result, an MSS/ATC operator in the L-band may increase the noise level of another co-primary MSS system by no more than 6% ΔT/T from the MSS/ATC operator's entire system, both MSS and ATC, without a specific coordination agreement being accepted by all affected parties. Three separate factors inform this decision. First, through the course of this proceeding, MSV has changed its ATC design substantially, and may do so again. In using MSV's originally-proposed ATC specifications as a basis for its technical analysis of interference, we intended to ground our analysis, and therefore its rules, in real-world considerations. It was not our intention to design our rules for MSV's proposed system, but rather to establish rules for all potential ATC systems in the L-band. Second, we agree with MSV's contention that we should not impose restrictions designed to limit self-interference. A more appropriate basis for interference limits is the interference an MSS/ATC system may cause to another MSS system in the L-band. Third, we note that Inmarsat provides both AMS(R)S and GMDSS communications.[103] In addition to our statutory mandate to prevent harmful interference,[104] we are determined to ensure that these safety and emergency communications suffer no degradation due to harmful interference.

42. We conclude that interference to other MSS systems is a better basis for our technical rules than self-interference. The International Telecommunication Union (ITU) has standards in place to protect GSO MSS systems from interference, in addition to well-defined methods to calculate the level of interference.[105] These standards permit an MSS provider to increase the noise level of another co-primary MSS provider's satellite receivers up to a level of 6% ΔT/T without coordinating.[106] An MSS provider in the L-band wishing to operate at a higher level of interference to co-primary MSS systems must coordinate and receive consent to do so from other MSS providers.[107] These standards have been effective in preventing harmful interference between L-band MSS providers.[108] Inmarsat urges us to reject the claims of an MSS licensee that it can withstand a self-interference level higher than 0.25 dB, which

[101] *See id.* at § 25.253(d)(1-2).

[102] *See id.* at § 25.253(d)(7).

[103] *See, e.g.*, 47 C.F.R. § 80.1187 (Inmarsat as part of GMDSS); § 87.187(q) (AMS(R)S) .

[104] *See* 47 U.S.C. § 303(f).

[105] *See* ITU-R RR Appendix 8 (rev. WRC-03).

[106] *See* ITU-R Rec. M.1086 which stipulates that the procedures of ITU-R Appendix 29 (now Appendix S8) be used in determining the ΔT/T between two geostationary MSS satellites, and that the satellite systems coordinate operations if the calculated value of ΔT/T is greater than 6%.

[107] *See* ITU-R Rec. M.1086.

[108] Inmarsat states that the interference tolerance of satellites is limited and does not account for terrestrial uses such as ATC. Inmarsat designs an interference allowance of approximately 25% ΔT/T in its system, and uses 6% ΔT/T from any one other satellite system as the basis for coordination. If MSV's ATC alone were allowed to create 6% ΔT/T, Inmarsat claims that this would consume almost a quarter of its entire interference margin, which would significantly constrain its ability to provide L-band M[illegible]S. Inmarsat stresses that ATC is merely an ancillary component of MSS, and claims that the interference caused by ATC should be included in the interference allowance for MSS systems. ATC interference must be kept at a low level, as our rules currently require, in order to ensure effective coordination and spectrum efficiency in the L-band, according to Inmarsat. *See* Inmarsat, *Inmarsat Opposition to Petition for Partial Reconsideration and Clarification of Mobile Satellite Ventures Subsidiary LLC* at 8-11. *See also* letter from John P. Janka, counsel for Inmarsat, to Marlene Dortch, Secretary, FCC, IB Docket 01-185, Appx. 1 at 5 (dated Feb. 3, 2005) (Inmarsat Feb 3 *Ex Parte* letter).

equates to 6% ΔT/T. Inmarsat argues that if an MSS/ATC operator were to exceed this level, the MSS/ATC operator would be required to either limit its ATC service, contrary to its business interests, or degrade its satellite performance.[109] We agree with MSV that interference to other MSS systems, rather than self-interference, is the appropriate concern upon which to base our interference rules. We also agree with Inmarsat that we should not allow an ATC, by itself, to interfere with another MSS system to a level of 6% ΔT/T.

43. We adopt a requirement that the permitted level of interference from one L-band MSS system into the satellite receivers of another L-band MSS system shall be no greater than 6% ΔT/T without a coordination agreement among the affected parties. Because ATC is an ancillary component of an MSS system, we consider interference caused by ATC operation as part of the 6% ΔT/T level of interference allowed from an MSS system without coordination, rather than allowing an MSS system with ATC a greater capacity to cause interference without coordination than an MSS system without ATC. Therefore, on any L-band channel an MSS/ATC system is entitled to use under the current L-band coordination agreement, and where another MSS system has a satellite within the visible arc from the MSS/ATC operator's area of coverage, the MSS/ATC operator may cause no more than a 6% ΔT/T increase in the system noise of the other co-primary operator's satellite system, unless the parties to the coordination agreement have coordinated to allow a higher level of interference, in which case the coordinated level serves as the baseline for permissible aggregate interference from all of the MSS/ATC provider's operations.

44. The current coordination agreement under which Inmarsat and MSV share L-band spectrum was finalized in 1999. Ideally, the L-band MSS operators should renegotiate their coordination agreement every year. Indeed, changes to the existing coordination agreement could help avoid some of the potential interference issues that could arise from deployment of MSS/ATC.[110] At the same time, however, we acknowledge that it could take a great deal of time and effort to conduct further coordination negotiations. For this reason, in the case of any L-band frequency that is currently the subject of a coordination agreement and is shared between an MSS operator and an MSS/ATC operator, we will permit an MSS/ATC to cause a small increase in interference to another MSS operator's system above the coordinated interference level when the coordinated interference level is already greater than 6% ΔT/T. This measure accounts for the reality that MSS is currently operating in the L-band, and that it may be necessary and appropriate to allow a slightly higher level of interference than currently coordinated levels allow in order to permit ATC to begin operations. When L-band MSS operators enter into a new coordination agreement, this additional interference allowance will no longer apply, and MSS/ATC operators will be required to operate its ATC within the limits coordinated by the parties.

45. Permitting interference from MSS/ATC operations in the United States to co-primary MSS systems on shared channels at the 1% ΔT/T level will allow MSS/ATC operators to implement ATC without undue risk of harmful interference, until such time as a new coordination agreement can be reached that considers interference from both MSS and ATC. This interim allowance of an additional 1% ΔT/T is higher than the 0.7% ΔT/T limit upon which we based our interference analysis in the *MSS Flexibility R&O*. We conclude that this value is reasonable because, as MSV points out, our conclusion in the *MSS Flexibility R&O* was that an increase of 0.7% ΔT/T in interference from the United States, and

[109] *See* Inmarsat *Petition* at 13-14.

[110] Such renegotiation could also facilitate the efficient usage and protection of new satellites that will be deployed over the next few years by both Inmarsat and MSV. While we encourage such renegotiation to occur at the earliest possible opportunity, we recognize that the existing agreement, which identifies frequencies available to each operator from specific orbital locations and antenna beams, and in some cases, interference levels coordinated between the operators, provides a basis under which current MSS operators can continue to operate as well as deploy and use new satellites and MSS/ATC.

another 0.7% ΔT/T from outside the United States, would not hinder Inmarsat's MSS operations.[111] Our analysis therefore accepted aggregate system-wide interference at a level of 1.4% ΔT/T.[112] MSV points out that it plans to deploy 80% of its ATC in the United States, and only 20% in Canada.[113] This is reasonable because of the much higher population of the United States. Thus, 80% of the total of 1.4% ΔT/T, or 1.12% ΔT/T, can be expected to emanate from MSV's ATC in the United States. We round this figure down to 1% ΔT/T to ensure that interference from ATC does not rise to a level that would interfere with MSS operations, while still allowing ATC to be rapidly deployed.

46. In summary, we adopt three interference limits for MSS/ATC operations in the L-band, varying with the channels in question.

- In any channel that is coordinated for the exclusive use of an MSS/ATC operator, and where there is no other MSS operator's satellite within the visible arc as seen from the ATC geographic coverage area, the MSS/ATC operator is limited only by in-band and out-of-band emissions limits and the need to control self-interference sufficiently to maintain substantial satellite service.

- In any channel which is coordinated for shared use between the MSS/ATC operator and another MSS operator, the MSS/ATC operator is permitted to cause interference to the other MSS operator up to a level of 6% ΔT/T from its entire MSS/ATC network.

- In any channel which is coordinated for shared use between the MSS/ATC operator and another MSS operator, and is coordinated to permit a level of interference from the MSS/ATC operator higher than 6% ΔT/T, the MSS/ATC operator's ATC may raise the interference to the other MSS operator an additional 1% ΔT/T without further coordination.[114]

47. This approach has several benefits. First, it allows MSS/ATC operators freedom to design their systems to meet a limit on uplink interference in the manner that they think best promotes the efficiency and utility of their service offering. They are in a better position to make decisions regarding the interference trade-offs between MSS and ATC that will produce the best service. Second, under this approach, L-band MSS/ATC providers will have a strong incentive to innovate, in order to get the maximum possible coverage and efficiency within their interference "budget" by using interference reduction techniques. We cannot predict what techniques may be invented or where such techniques will prove most effective, in the MSS component or the ATC of an MSS/ATC system. Finally, our revised approach supports and encourages private coordination agreements among the interested parties in the band. Private negotiations between expert parties with their business interests at heart are more likely to produce the most efficient interference levels than regulations based on largely hypothetical cases. We therefore will permit interference levels above 6% ΔT/T where the parties have reached coordination agreements. We note that the Mexico City MoU contemplated such coordination sessions on an annual basis.

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[111] *See* MSV *Petition* at 6 (citing *MSS Flexibility R&O* at 2170, Appx. C, ¶ 2.1.1).

[112] *See id.*

[113] *See id.*

[114] We note that the existing coordination agreement does not specify current ΔT/T protection levels. However, such levels can be calculated using either ITU-R Appendix 8 (Rev.WRC-03) or the methodology that was presented in our *MSS Flexibility R&O*. We would expect both parties to approach the development of a new coordination agreement in good faith and to apply good engineering judgment to determine the various factors and trade-offs that must go into the evaluation of sharing between an MSS system and an MSS/ATC system. The methodology that was presented in our *MSS Flexibility R&O* could be used as an example of the different factors that could be taken into account in determining the interference from an MSS/ATC system into an MSS system.

2. Other Issues

48. Because of the change in our interference standard, and the elimination of certain technical rules, we dismiss as moot several requests for changes to those technical rules. MSV petitioned for an increase in the number of base stations each MSS/ATC operator is permitted on two separate grounds.[115] Our overall limit on the interference an MSS/ATC operator may cause to other MSS systems obviates the need for a numerical limit on ATC base stations. MSV also requests that we amend the rules to allow the use of half-rate vocoders and channels, as opposed to quarter-rate vocoders and channels.[116] This rule is also rendered unnecessary by our new interference standard.

49. Inmarsat requests that we require MSS/ATC applicants to provide a full description of their ATC architecture.[117] Inmarsat also requests that the restriction we applied limiting the number of simultaneously-transmitting ATC handsets to 90,000 be inserted into the rules, noting that the restriction is in the text of the *MSS Flexibility R&O*, but not in the rules.[118] We are also removing these requirements from our rules, replacing them with an overall limitation on the amount of interference an MSS/ATC system can cause to another MSS system in the L-band. For this reason, we dismiss Inmarsat's requests as moot.

50. Because we are allowing MSS/ATC providers to apportion their interference budget between MSS and ATC according to their own designs and business plans, and to change those apportionments without further approval as long as the sum of the ATC and MSS interference remains below the levels required, we have little basis for limiting the number of base stations or mobile handsets, so we will eliminate these limits. The intent of these rules was to limit the total interference caused by ATC. These specific numerical limits were based on an analysis of MSV's proposed ATC. Many of the values proposed by MSV have changed. More importantly, we believe that it is important to allow MSS/ATC licensees flexibility to design their ATC in accordance with technical and market demands. We have decided that a better way to achieve this goal is to limit the total interference that an ATC may cause, rather than dictating system design features.

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[115] MSV requested that we increase the limit on co-channel base stations in the United States from 1725 to 2760 based on the fact that we assumed in the *MSS Flexibility R&O* that MSV would deploy one-half of its ATC network in the United States. Therefore, according to MSV, we intended to limit co-channel base stations to 3450 network-wide, half in the United States and half outside the United States. Because it plans to deploy approximately 80% of its ATC network within the United States, MSV requested that we increase the permitted number of co-channel base stations in the United States to 80% of the network-wide total, or 2760. *See* MSV *Petition* at 5-6 (*citing* 47 C.F.R. § 25.253(c)). MSV also requests that we increase the number of permitted co-channel base stations to 14,785 based on its argument that ATC should be allowed to interfere with co-primary MSS systems to a level of 6% $\Delta T/T$. *See id.* at 15.

[116] A vocoder converts the caller's voice into a digital signal for transmission and converts the received digital signal back into intelligible voice. By reducing the rate of the vocoder, the transmitter can reduce the interference caused by the transmission, at the expense of voice quality. MSV states that in the *MSS Flexibility R&O*, we assumed that MSV would use a quarter-rate vocoder and channel and that this would reduce the effective isotropic radiated power of MSV's ATC handsets by 3.5 dB. MSV claims that this reduction in EIRP will be achieved with a half-rate vocoder. *See* MSV *Petition* at 14. Contrary to MSV's assertions, 47 C.F.R. § 25.253(a)(2) requires the use of a variable-rate vocoder, not a quarter-rate or half-rate vocoder.

[117] Inmarsat requests that we require such a description to include a detailed demonstration that the cell structure of the ATC includes an 18 dB link margin for structural attenuation and that this margin will be used only for service to mobile handsets indoors. *See* Inmarsat *Petition.* at 11. *See also* Inmarsat Feb 3 *Ex Parte* letter at Appx. 5.

[118] Inmarsat seeks clarification that this limit applies to all MSS/ATC operators in the L-band, not to each such operator, because it claims that the latter interpretation would have no relation to the assumptions underlying our interference analysis. *See* Inmarsat *Petition* at 13.

51. While we are eliminating many of our more detailed technical rules on uplink interference, we expect MSS/ATC providers will use, and be able to document compliance with, realistic technical parameters when calculating the increase in uplink interference (*i.e.*, $\Delta T/T$) to other MSS systems. For example, if a party relies on an 18 dB structural attenuation link budget during coordination, it must be able to demonstrate how its system will ensure compliance with that parameter. Similar demonstrations would be needed for other key parameters, such as the vocoder/power relationship, number of mobile users, etc. We retain the authority to request the values used for these factors and the demonstrations used to justify them.[119]

C. Downlink Interference in the L-Band

52. Background. Where uplink interference protection is concerned with interference into the satellite receiver of an MSS system, downlink interference protection ensures that receivers on or near the surface of the Earth are able to receive signals without harmful interference. As we stated in the *MSS Flexibility R&O*, the potential for interference may exist in four ways: (1) overload of the land-based mobile earth terminal (MET) receiver[120] from in-band emissions when in close proximity to ATC base stations; (2) out-of-band interference to the land-based MET from ATC base stations; (3) aggregate interference to the airborne MET from multiple ATC base stations; and (4) overload of the airborne MET from an ATC base station.[121] To protect METs from overload, we established a power limit on ATC base stations of 19.1 dBW per carrier with no more than three carriers per sector,[122] and 14.1 dBW EIRP per carrier toward the horizon.[123] To protect land-based METs from out-of-band interference, we adopted an out-of-band emission limit of -57.9 dBW/megahertz for ATC base stations.[124] To protect airborne METs from out-of-band interference, we established overhead gain limits for ATC base stations dependent on the angle of maximum gain from the base station antenna.[125] We determined that airborne receiver overload was not expected to occur, and so established no technical limits on this basis.

1. ATC Base Station Power Levels

53. We grant a request from MSV to reconsider the power limits on base stations, and generally allow an 8dB increase in base station power.[126] With an added 15 dB of margin, MSV claims that we can increase the permitted EIRP of ATC base stations from 23.9 dBW to 38.9 dBW, with an aggregate peak EIRP in any direction from all base station sectors of no more than 53.9 dBW, and the EIRP toward the

[119] MSV is the only L-band MSS provider currently authorized to provide ATC. Our elimination of some technical rules here does not affect the terms of MSV's ATC authorization. MSV must conform to all the terms of its ATC authorization unless it applies for modification of its license and demonstrates that the modifications it proposes would be consistent with the limits on interference we adopt here.

[120] Overload occurs when the total input power to the receiver drives the receiver from its operational linear state to a non-linear state, which results in distortion of the desired input signal or, in the case of severe overload, the inability of the receiver to operate.

[121] *See MSS Flexibility R&O* at 2038, ¶ 148.

[122] *See MSS Flexibility R&O* at 2038, ¶ 148; 47 C.F.R. § 25.253(d)(1).

[123] *See MSS Flexibility R&O* at 2039, ¶ 152; 47 C.F.R. § 25.253(d)(2).

[124] *See MSS Flexibility R&O* at 2041, ¶ 157; 47 C.F.R. § 25.253(b).

[125] *See MSS Flexibility R&O* at 2042, ¶ 160; 47 C.F.R. § 25.253(e).

[126] MSV claims that it submitted "uncontroverted evidence" that the overload threshold for Inmarsat METs is -45 dBm, instead of the -60 dBm value we used in our calculation. MSV submits measurements it conducted of the 1 dB compression point of the receiver front-ends in Inmarsat's land-based and maritime METs produced by a variety of manufacturers. This data purports to demonstrate that "even an in-band signal level of -45 dBm does not overload an Inmarsat land-based or maritime MET." *See* MSV *Petition* at 16-17; Appx. C.

horizon from 18.9 dBW to 33.9 dBW per sector.[127] Inmarsat disputes MSV's contention, asserting that it has provided reports from two separate manufacturers of Inmarsat METs, demonstrating that a receiver overload threshold of at most -75 dBm is necessary to protect Inmarsat from out-of-band interference from ATC base stations[128]

54. We are presented with two opposing propositions from MSV and Inmarsat. MSV states that the appropriate MET receiver overload threshold upon which to base our downlink interference calculations is -45 dBm. Inmarsat claims that the appropriate threshold is -75 dBm. Both parties provide reports and measurements to support their assertions. Faced with the need to decide among these two alternatives or the -60 dBm threshold we used in our downlink interference calculations in the *MSS Flexibility R&O*, the staff conducted tests of the overload thresholds of representative METs, supplied by MSV and Inmarsat. The report of these tests is attached as Appendix A.

55. The testing indicates that most of the Inmarsat receivers tested outperform the overload limit of -60 dBm used in our analysis in the *MSS Flexibility R&O*. From the test data, we conclude that Inmarsat receivers can tolerate another 8 dB increase in power when the interfering signal is more than approximately two megahertz removed from the desired signal.[129] This tolerance is 8 dB better than the assumed tolerance of -60 dBm upon which we based our ATC base station power limits. We also note that in an *ex parte* filing, MSV requested a waiver of our rules to allow an additional 8 dB of base station power, both generally and near airports and waterways,[130] in place of the 15 dB increase MSV requested in its petition. For this reason, we grant MSV's request to change the power limits on base stations, as follows. Generally in the L-band, the EIRP of ATC base stations shall be limited to 31.9 dBW, and the EIRP toward the horizon shall be limited to 26.9 dBW per base station sector. This represents an 8 dB increase over the current power limits that apply when three carriers are used within an antenna sector.

56. The testing our staff conducted also indicates that in cases where the interfering signal is less than approximately two megahertz removed from the desired signal, our assumption of Inmarsat MET receiver tolerance of -60 dBm was correct. Generally, we do not regulate the susceptibility of receivers to interference from transmissions on nearby frequencies. Rather, we rely on the marketplace – manufacturers and service providers – to decide how much susceptibility to interference will be acceptable to consumers. In addition, we generally do not limit one party's ability to use the spectrum based on another party's choice regarding receiver susceptibility. In this situation, it is clear from our testing and our knowledge of receiver design that Inmarsat can deploy receivers in the future that can be less susceptible to interference from transmissions on nearby frequencies. We recognize, however, that it is important to provide some amount of protection to current receivers used by Inmarsat in the L-band because some of Inmarsat's operations are safety-related, though these safety-related transmissions are likely to be limited in quantity. Furthermore, it is not clear that there will be great usage of Inmarsat MSS signals near urban areas where MSS ATC L-band transmitters will be deployed. This is because: 1) MSS signals are often obstructed by buildings and the environment in general, and 2) there are other more reliable and cheaper modes of communication that are more likely to be used (e.g., VHF air traffic

[127] *See id.* at 17-18. The peak EIRP level of 19.1 dBW per carrier, with no more than three carriers per sector, specified in 47 C.F.R. § 25.253(d)(1) equates to an aggregate EIRP per sector of 23.9 dBW. The EIRP level of 14.1 dBW toward the horizon per carrier specified in 47 C.F.R. § 25.253(d)(2) equates to an aggregate EIRP toward the horizon per sector of 18.9 dBW.

[128] Specifically, Inmarsat claims that the overload threshold of its METs is -72 dBm at a one megahertz frequency offset, and lower still at offsets of less than one megahertz. For this reason, Inmarsat requests that we recalculate the ATC base station power limits based on an overload threshold of -75 dBm, instead of the -60 dBm we used in our calculation. *See* Inmarsat *Petition* at 15-17; Inmarsat *Opposition* at 16.

[129] *See* Appx. A, § 3.

[130] *See* MSV Aug. 2 *Ex Parte* letter at 1.

control, VHF marine, CMRS communications, and landline). As such, we conclude that it is inefficient and unnecessary for us to limit MSS ATC deployment at higher power levels on all frequencies in the L-band.

57. The 1544-1545 MHz sub-band, within the MSS L-band allocation, is limited to distress and safety communications.[131] Thus, it is reasonable to provide greater protection against interference in this particular sub-band. In reviewing our receiver test results, as discussed earlier, we found that current Inmarsat receivers can generally tolerate increased ATC power levels and power flux density (PFD) levels provided they are more than approximately two megahertz away in frequency from the desired signal. After reviewing the current frequency sharing agreement governing use of the L-band in North America by MSS licensees, we conclude that distress and safety communications should have adequate protection from critical interference due to increased ATC transmitted power and increased PFD limits if we limit such increases to spectrum outside the 1541.5-1547.5 MHz band (that is, 2.5 megahertz away from the band edges of the 1544-1545 MHz sub-band). We recognize that some consumers may wish to transmit non-safety traffic through an MSS system even when located in urban areas near MSS/ATC transmitters, and that those transmissions would have to be on frequencies outside the 1544-1545 MHz sub-band. Nevertheless, it appears that Inmarsat and other MSS operators should have adequate ability to support such operations, either by providing those users with receivers that are less susceptible to interference or by directing non-safety traffic to frequencies that are adequately removed from higher-power ATC transmissions in a particular area. In this regard, we note that under the current frequency sharing agreement, MSV's operations are limited to significantly fewer frequencies than Inmarsat's operations. Furthermore, parties to coordination negotiations that will be needed in the [illegible]and for next-generation satellite deployment and large-scale deployment of ATC can accommodate [illegible] operations in their negotiations. In order to protect the safety functions of Inmarsat operations, our rules, based on a receiver tolerance of interference at -60 dBm, will remain in place for the portion of the L-band at 1541.5-1547.5 MHz.[132]

58. Our testing also revealed another potential source of interference to Inmarsat METs: third-order intermodulation interference. Third-order intermodulation interference occurs when two frequencies, both removed from the frequency carrying the desired signal, interact to cause interference to the frequency carrying the desired signal.[133] Our testing indicates that Inmarsat's receivers may be vulnerable to intermodulation interference, depending upon the combined power of the two unwanted signals. Our testing showed that the four terminals tested will not experience third-order intermodulation difficulties if the combined power at the receiver from the two unwanted signals is less than -70 dBm.[134]

59. To resolve third-order intermodulation problems, we require any MSS/ATC operator to notify the affected MSS operator in any case where a single base station or multiple base stations will transmit on frequencies that can produce third-order intermodulation products that overlap a frequency assigned to the affected MSS operator in the 1525-1559 MHz band, where such transmissions will result in a signal level of -70 dBm or higher for the combined signals at the output of the affected MSS

[131] *See* 47 C.F.R. § 2.106, n.5.356.

[132] In this portion of the band, ATC base stations will be limited to a peak EIRP of 19.1 dBW per carrier and 14.1 dBW toward the physical horizon per carrier. *See* 47 C.F.R. § 25.253(d).

[133] Determining the frequencies whose interactions can cause intermodulation to the desired frequency is accomplished by applying the formula $2f_1 - f_2 = X$, where f_1 and f_2 are the frequencies producing the intermodulation, and X is the desired frequency.

[134] *See* Appx. A, Figure 3. The single exception occurs in the tests of Terminal C with cdma2000 modulation where sensitivity to having one of the two unwanted signals near 1552 MHz occurred. This sensitivity was probably due to an image rejection problem in the receiver as discussed in Attachment A, n.19.

operator's terminal's receiving antenna.[135] The MSS/ATC operator and the affected MSS operator must work together to resolve the interference problem. We note that careful selection of base station frequencies by the MSS/ATC operator can minimize the number of situations in which this problem will arise, as could aggregating the channels used by the different MSS operators through the coordination process.

60. The rules specify the maximum permitted EIRP per carrier and limit to three the number of carriers per ATC base station sector.[136] MSV requests that we eliminate the restriction on the number of carriers per sector.[137] Because it is the total EIRP produced within an ATC base station sector that can cause receiver overload, the number of carriers used to generate that EIRP level is inconsequential. An ATC base station could be implemented with a few high power carriers or many low power carriers. As long as the EIRP resulting from the different implementations was the same, the interference potential would be the same. Therefore, we grant MSV's request and remove the limitations on the number of carriers per ATC base station sector from the rules.[138]

2. Protection of Airports and Waterways

61. Background. In the special case of ATC base stations near airport runways or waterways, we grant an 8 dB increase in PFD limits, with certain restrictions. Our testing of Inmarsat METs found that they were able to tolerate 8 dB more interference than we assumed in the *MSS Flexibility R&O*, which justifies an 8 dB increase in PFD. In the *MSS Flexibility R&O*, we determined that these areas required additional protection for METs, due to the fact that they tend to be open, with few buildings, where signal propagation from ATC base stations will be closer to "free-space" conditions than it would be in urban areas with heavy concentrations of buildings and other obstructions.[139] We decided that protection of METs from interference in these situations required a physical separation for ATC base stations of a minimum of 470 meters from any runway or aircraft stand area.[140] To further protect aircraft METs from interference, we also required ATC base stations to produce a PFD of no more than -73.0 dBW/m² per 200 kilohertz channel at the edge of airports.[141] In the case of waterways, we required that ATC base stations be separated by 1.5 kilometers (0.9 miles) if there is a clear view of the water, and that ATC base stations could produce a PFD of no more than -64.6 dBW/m² per 200 kilohertz channel at the edge of navigable waterways.[142]

62. Asserting that these protection requirements are unnecessarily stringent, MSV requests that we allow an additional 15 dB of PFD at the edges of airports and navigable waterways, based on its measurements of Inmarsat MET receiver front-end one-dB compression points that purportedly

[135] For the purpose of determining when a signal at the output of an MSS terminal antenna is greater than -70 dBm, a calculation based on free-space propagation, and omni-directional antenna, and the actual polarizations used by the ATC base station and the MSS system may be used. Unless otherwise justified, the MSS terminal should be assumed to be at ground level.

[136] *See* 47 C.F.R. § 25.535(d)(1).

[137] *See* letter from David S. Konczal, counsel for MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185, Appx. at 18 (dated Mar. 10, 2004).

[138] We note that in implementing a multiple-carrier base station, the EIRP level of each carrier can be expressed as the total EIRP divided by the number of carriers. Alternately, expressed in decibels, the EIRP per carrier will be the peak EIRP-10*log(number of carriers). *See* Appx. B, § 25.253.

[139] *See MSS Flexibility R&O* at 2178, Appx C2, ¶ 2.2.1.3.

[140] *See id.* at 2040, ¶ 154; 47 C.F.R. § 25.253(d)(3).

[141] *See MSS Flexibility R&O* at 2040, ¶ 154; 47 C.F.R. § 25.253(d)(4).

[142] *See MSS Flexibility R&O* at 2040, ¶ 154; 47 C.F.R. § 25.253(d)(5).

demonstrates that the proper overload threshold is -45 dBm, rather than the -60 dBm we used in our calculations.[143] Further, MSV contends that our approach of requiring both separation distances and PFD limits in the case of airports and waterways deprives ATC providers of flexibility and is unnecessary to protect METs from interference.[144]

63. Discussion. Because of the results of our testing, we deny Inmarsat's request that we recalculate the PFDs and separation distances relevant to airports and waterways based on an overload threshold for Inmarsat METs of -75 dBm, rather than the -60 dBm or -50 dBm that we used in calculating these limits. The analysis of PFDs at edges of airports and waterways is contained in Appendix C2 of the *Flexibility R&O*. That analysis assumed that Inmarsat maritime METs could tolerate an unwanted signal level of -60 dBm while Inmarsat airborne METs could tolerate an unwanted signal levels of -50 dBm. Because our tests indicated that Inmarsat MET receivers are capable of tolerating an interference level of -52 dBm, a level 8 dB higher than the -60 dBm we assumed in setting PFD limits near waterways, we will permit an increase of 8 dB in the PFD permitted at the edges of waterways.

64. With respect to airports, we use the results of our tests and base PFDs on an interference level of -52 dBm. Inmarsat indicates that theoretical calculations predict that receiver overload should occur at levels around -54 dBm for its "Aero H" receivers and -[illegible]Bm for its higher data-rate "S64" receivers.[145] We believe, however, that these calculations represent a worst-case situation that is several dB worse than would be expected in real-world receivers. While we did not test an airborne MET receiver, we have no reason to believe that airborne receivers, which must meet stringent government testing and approval standards, would perform worse with respect to receiver overload than the other MET receivers that we did test. As with our decision to increase the limits on ATC base station power generally, the PFD limits that we adopted in the *MSS Flexibility R&O* will remain in force for the sub-band at 1541.5-1547.5 MHz, except that the PFD limits for airports will be reduced by 2 dB to reflect the results of our testing. We acknowledge Inmarsat's concern that METs aboard aircraft are part of a safety service, as well as the statement of Aeronautical Radio, Inc. and the Air Transport Association of America (ARINC/ATA) that AMS(R)S communications use the Inmarsat space segment, and that these communications are time-critical, safety communications that require protection under ITU regulations.[146] However, continuance of the more stringent PFD limits in the 1541.5-1547.5 MHz sub-band adequately assures the protection of safety and emergency communications in the 1544-1545 MHz sub-band. Accordingly, we change the PFD limit for ATC base stations at the edges of airports to -56.8 dBW/m^2/200 kilohertz, summed over all carriers in a sector for the full 1525-1559 MHz band,[147] and for ATC base stations at the edges of waterways to -56.6 dBW/m^2/200 kHz, summed over all carriers in a sector, for carriers outside the sub-

[143] *See* MSV *Petition* at 19.

[144] MSV contends that ATC providers should be able to site base stations outside the separation distances without having to measure the PFD produced, and that alternate ATC providers should be allowed to site their base stations within the separation distances if they measure the PFD at the edges of airports and waterways, and those PFDs are within the limits in the rules. *See id.* at 20-21; MSV *Reply* at 9.

[145] *See* Inmarsat Feb 3 *Ex Parte* letter at 42-49.

[146] *See* ARINC/ATA *Comments* at 2.

[147] MSV correctly pointed out that there was a numerical error in the calculation of the PFD at the edge of a airport contained in Attachment C2 of the *MSS Flexibility R&O*, although the calculation supplied by MSV was also incorrect. We base the PFD calculated here on the following parameters: an Inmarsat terminal receive gain of 0 dBi, a polarization isolation of 0 dB, a frequency of 1542 MHz (center of the band), and an interference tolerance level of -52 dBm. *See* letter from Bruce Jacobs, counsel for MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 1-2 (dated Nov. 18, 2003).